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(54) Pirani gauges

(57) In a circuit for controlling the temperature of a filament F in a Pirani gauge head, secondary temperature compensation is provided by mounting an auxilliary resistor T2 adjacent the temperature-compensating arm T1 of the bridge circuit 6. The resistor T2 forms part of a potential divider which provides a preset offset voltage to an associated output amplifier 10 This offset voltage is added algebraically to the variable voltage driving the bridge circuit 6 so as to provide additional temperature compensation. The measured value is thus accurate over the whole of the operating range instead of at just one point.
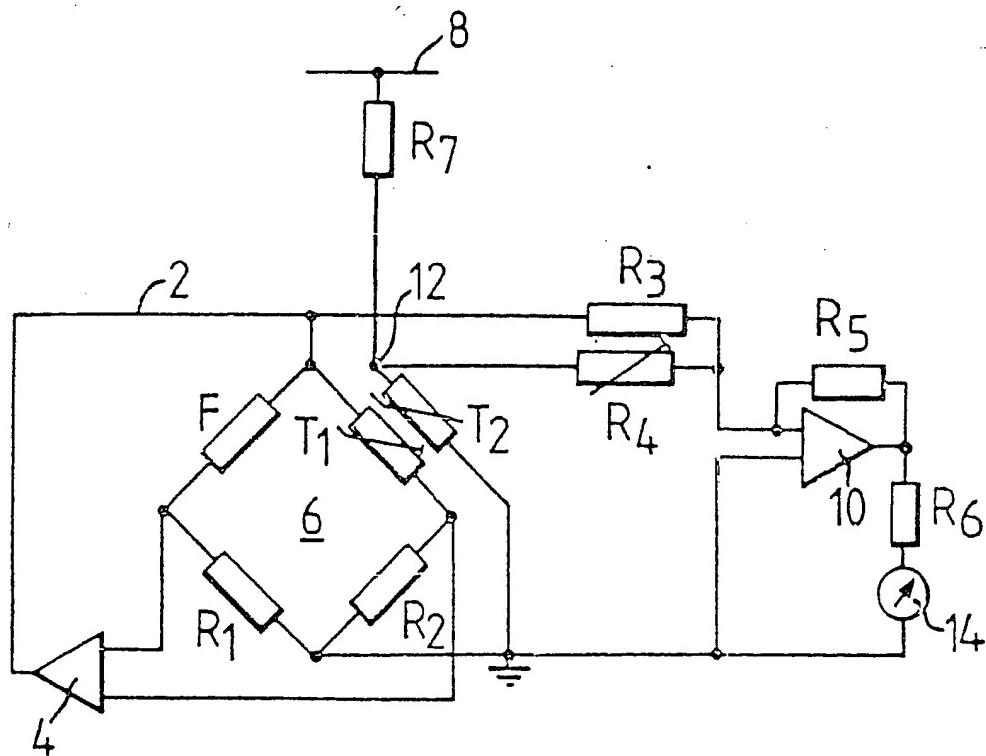
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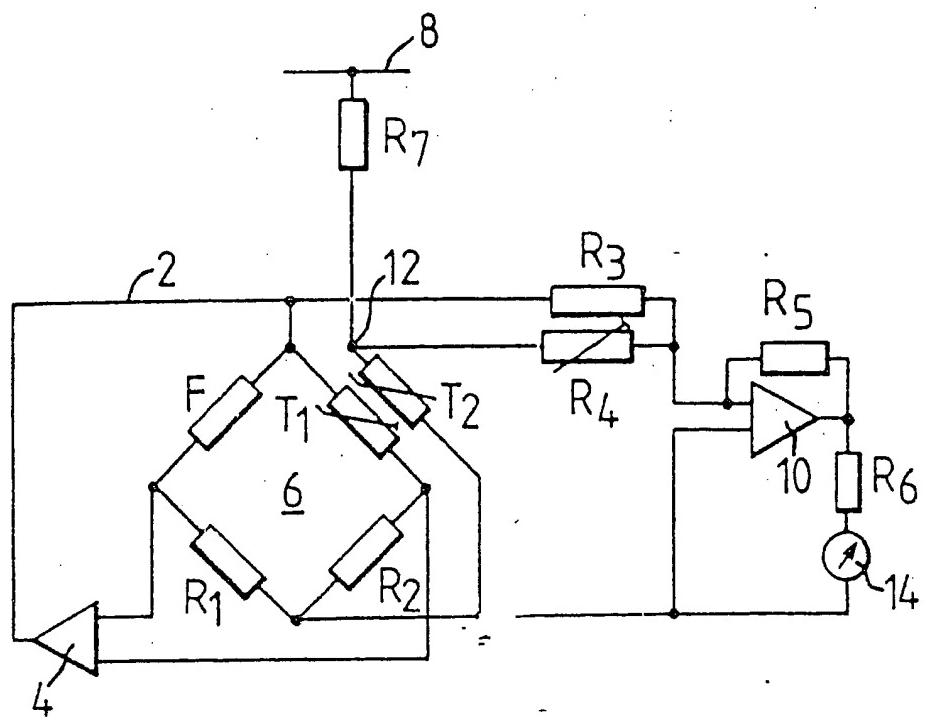
SPECIFICATION

Gas pressure measuring circuit

5 The present invention relates to a measuring
circuit for a Pirani gauge. Such gauges are
used for measuring the pressure of a gas by
means of a heated filament of which the
temperature is measured in terms of its electri-
10 cal resistance. The temperature of the fila-
ment, or the rate at which it loses heat to its
surroundings, is a function of the gas pres-
sure, and hence either of these factors may be
used to permit the gauge to measure vacuum.
15 In a Pirani gauge, the filament is in one arm
of a Wheatstone bridge circuit. The gauge
may be operated in either a constant tempera-
ture or a constant voltage mode. In the former
mode, the rate at which energy is supplied to
20 keep the filament at a constant temperature is
varied with changes in gas pressure, and
hence this rate of change acts as a measure of
the degree of vaccum. In the latter mode, the
variation with gas pressure in the electrical
25 imbalance of the bridge acts as a measure of
the degree of vaccum.
    The measuring circuit of the present inven-
tion is designed to operate in the constant
temperature mode.
30   In known Pirani gauges, some degree of
temperature compensation is provided by put-
ting a temperature-dependent resistor in
another arm of the bridge. The resistance
variations with temperature which this pro-
35 duces apply throughout the whole of the
normal temperature range of operation of the
gauge, which is usually 10 to 50°C, but
complete compensation can be effected only
at one temperature, which is arranged to be at
40 one end of the scale.
    The present invention according to its broa-
dest aspect, provides a circuit for operating a
Pirani gauge comprising an electrical bridge
which has one arm adapted to receive the
45 gauge and which is arranged to produce an
output signal representative of gas pressure
within the gauge, electrical means not em-
bodied within an arm of the bridge and effec-
tive to produce a signal indicative of the
50 ambient temperature in which the gauge oper-
ates together with signal translation means
responsive to the output of the bridge and of
the electrical means and capable of producing
a gas pressure signal compensated for ambi-
55 ent temperature changes.
    Conveniently the electrical means comprises
a resistive element which preferably forms
part of an electrical network such as a poten-
tial divider across which a substantially con-
60 stant potential difference is applied. The po-
tential appearing at a tap of the divider
suitably is, together with the signal from the
bridge, applied to the input of an amplifier
whose output can be used to provide an
65 indication of temperature compensated gas

pressure.
    In a preferred embodiment of the invention
a degree of temperature compensation addi-
tionally is provided by a resistive element
70 embodied in one arm of the bridge.
    An embodiment of the invention will now
be described by way of example with refer-
ence to the accompanying drawing which is
schematic diagram of a circuit for a pirani
75 gauge.
    Referring to the drawing, the resistor F is
the Pirani gauge filament which is to be
heated by current drawn from a variable vol-
tage rail 2 drawing its power from the output
80 of an amplifier 4. The balancing arm of the
bridge 6 includes a primary temperature-com-
pensating resistor T1. The other two ratio
arms of the bridge 6 are provided by resistors
R1 and R2.
85   Situated adjacent to resistor T1 is a resistor
T2 providing the improved temperature com-
pensation. It is adjacent to resistor T1 in order
to be subjected to the same temperature
changes as that resistor. Resistor T2 is con-
90 nected to a constant voltage rail 8 through a
resistor R7. Because the other side of resistor
T2 is connected to earth, resistors R7 and T2
form a potential divider, the mid-point of
which is coupled through a preset resistor R4
95 to the input of a second amplifier 10 which is
bridged by resistor R5. The variable voltage
rail 2 is connected through resistor R3 to
same input of the amplifier. In this way, the
variations in the voltage of point 12 caused
100 by fluctuations in the resistance of resistor T2,
lead to a voltage being added algebraically to
that at the outlet of resistor R3, so as to
produce the desired offset in the effective
voltage of rail 2. This offset voltage is ampli-
105 fied by amplifier 10 and fed through a resistor
R6 to a meter 14 which is calibrated in terms
of gas pressure.
    By virtue of the connection of the respec-
tive diagonal of bridge 6 across the inlets of
110 amplifier 4, the signal in rail 2 varies as a
function of the value of the resistance of
filament F, with the voltage applied across the
signal diagonal of bridge 6 being designed to
keep this resistance, and therefore the temper-
115 ature of filament F, constant.
    The primary compensating resistor T1 can
be preset, as illustrated, so that it exactly
compensates for other variations at one point
in the operating temperature range of the
120 associated Pirani gauge. As the temperature
of the secondary resistor T2, varies in opera-
tion of the gauge, the offset voltage fed
resistor R4 has its amplitude controlled by
presetting R4 at a chosen temperature. It has
125 been found that the characteristics of resistors
T1 and T2 complement each other to a large
extent so that the resultant circuit indicates
the measured gas pressure more accurately
over the normal range of operating tempera-
130 ture.

CLAIMS

1. A circuit for operating a Pirani gauge comprising an electrical bridge which has one
5 arm adapted to receive the gauge and which is arranged to produce an output signal representative of gas pressure within the gauge, electrical means not embodied within an arm of the bridge and effective to produce a signal
10 indicative of the ambient temperature in which the gauge operates together with signal translation means responsive to the output of the bridge and of the electrical means and capable of producing a gas pressure signal
15 compensated for ambient temperature changes.

2. A circuit as claimed in claim 1 wherein the Pirani gauge is arranged to operate in a constant filament temperature mode.

20 3. A circuit as claimed in claim 1 or claim 2 wherein the electrical means comprise a temperature-sensitive, resistive device.

4. A circuit as claimed in claim 3 wherein the resistive device forms part of a network
25 and is effective to produce from a potential difference applied across the network a signal responsive to temperature change.

5. A circuit as claimed in claim 4 wherein the resistive device forms part of a potential
30 divider.

6. A circuit as claimed in claim 5 wherein the signal from a tap of the divider and the bridge output signal are applied to the input of an amplifier whose output can be used to
35 provide representatives of temperature-compensated gas pressure.

7. A circuit as claimed in preceeding claim wherein a resistive device is provided in an arm of the bridge to provide temperature
40 compensation.

8. A circuit as claimed in claim 7 wherein both resistive elements are proximate.

9. A circuit for operating a Pirani gauge substantially as herein described with refer-
45 ence to the accompanying drawing.

10. A Pirani gauge operating circuit substantially as shown in and adapted to operate substantially as herein described with reference to the accompanying drawing.